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The Efficacy of fragrance use for enhancing the slot machine gaming experience of casino patrons

Gael D. Hancock
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THE EFFICACY OF FRAGRANCE USE FOR ENHANCING THE SLOT
MACHINE GAMING EXPERIENCE OF CASINO PATRONS

by

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Bachelor of Arts in Economics
Hendrix College, Conway, Arkansas

A thesis submitted in partial fulfillment
of the requirements for the

Master of Science Degree in Hotel Administration
William F. Harrah College of Hotel Administration

Graduate College
University of Nevada, Las Vegas
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THE GRADUATE COLLEGE

We recommend that the thesis prepared under our supervision by

Gael D. Hancock

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ABSTRACT

The Efficacy of Fragrance Use for Enhancing the Slot Machine Gaming Experience of Casino Patrons

By

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Once guests are inside a casino, experiential factors within the casino must be managed so that these guests are encouraged to engage in the gaming opportunities; remain in the casino to eat and shop; return to the casino; and hopefully, to recommend the casino to others. Ambient conditions have been shown to influence a person's willingness to stay in a public setting and their repatronage intentions. Air fragrance is one small, but controllable piece of the experience puzzle that includes décor, lighting, music and other ambient sounds, comfort of the seating, quality of the service, perception of cleanliness and ease of locating important destinations such as restrooms, cashiers, or exits.

An experiment was conducted in a large United States casino using four fragrances that were rotated through five different slot machine areas over a 20-day period. Analysis of the daily coin-in data for the 253 slot machines during the actual experiment and two and a half months prior, showed fragrances in general significantly and positively affected coin-in. Of the four fragrances, both a refreshing and a soothing fragrance blend with high percentages of natural components, rather than from predominately synthetic sources, significantly and positively affected coin-in.

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I want to thank the people at the casino where I conducted the experiment for their incredible generosity and support. Even though I was there in a research capacity, I was treated like a valued guest. They provided me with access to data, information and the property itself. They helped me set up and take down my equipment. They even shipped the equipment back to the manufacturer when the experiment was over. This casino typifies the definition of customer excellence—I learned much more from this experience than what was covered by my research project.

Second, I want to thank Mark Peltier, president and owner of AromaSys, Inc., who provided me with the fragrance machines and the fragrances. He spent many hours with me working through ideas, possible locations for the equipment, and different fragrance options. I am also grateful to his wife, Eileen Kenney, vice president of AromaSys, Inc. and fragrance developer, who provided information on the fragrances.

Finally, I want to thank my family and friends who have been supportive, funny and encouraging. They served as sounding boards for all of the ideas I've had about the experiment. They made good suggestions, helped me look at things in different ways, and kept me on track. They proofread the materials. They made thesis jokes. But most of all, they were kind and understanding when I hid away to get the work done.

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CHAPTER 1

INTRODUCTION

Purpose of the Study

Background

The market research has been completed, the ads placed in publications and run on television, the email and direct mail pieces have been sent and received, and as a result, there are people in the casino. Now, somehow, these casino guests must be turned into gaming patrons—those visitors who engage in the gaming opportunities. They must be convinced to spend time in the casino: gambling, dining at the restaurants, going to the shows and shopping at the retail outlets. It can also be hoped that the experience at the casino will be so positive—whatever that may mean for the individual guest, be that perhaps exciting, relaxing, fantasy-like, thrilling, dangerous—that he or she will return to the property and possibly even recommend it to others.

The ambient fragrance in the casino is one controllable factor of the experience puzzle that includes, but is not limited to décor, lighting, music and other ambient sounds, comfort of the seating, quality of the service, perception of cleanliness, and ease of locating important destinations, such as restrooms, cashiers, or exits (Bitner, 1992; Johnson, Mayer, & Champaner, 2004; Lucas, 2003; Mayer & Johnson, 2003; Mayer, Johnson, Hu & Chen, 1998; Watkins, 2006). Fragrances have been used for thousands of years to enhance specific experiences and influence behavior (Ackerman, 1990). The targeted use of specific fragrances in casinos may be shown to affect mood, enhance the experience, and influence the actions of casino guests in a similar manner. The purpose of

this study is to examine the effects of fragrances—both synthetic and from natural sources—on casino patrons. Effects will be measured by coin-in.

Fragrance Use in Public Locations

Today, fragrances are used in a broad range of public locations to affect visitor experiences. Lavender, known to be a calming fragrance, is used in doctors' offices to help quell patient anxiety (Lehrner, Marwinski, Lehr, Jöhren, & Deecke, 2005). Lexus showrooms in Japan change fragrances to reflect the seasons, e.g., cherry blossom in spring. Furniture stores waft the fragrances of cedar and leather throughout the showroom floors to create an impression of high-quality merchandise ("Fragrance of Success," 2006). Fragrances are used in retail outlets to lure customers into stores. Even airports are using fragrances. Heathrow Airport uses the scent of pine needles to soothe travelers (Levack, 2008).

Harrods, the luxury department store in London, honored all of the senses with a unique exhibition. The six elevators or lifts were each dedicated to the five recognized senses and a new sixth sense, "Cosmic Ordering," where wishes can be granted. The tribute to the sense of smell featured buttons that released new car, laundry and pomegranate fragrances ("Lifted at Harrods," 2008; Soars, 2009).

Fragrance Use in the Hospitality Industry

Singapore Airlines has had a signature scent since the late 1990s. According to Martin Lindstrom (2005) "The patented aroma has since become a unique trademark of Singapore Airlines" (p. 15). This fragrance, called Stefan Floridian Waters, is wafted through the cabin of the airplanes and drifts up from the warm towels distributed after meals (Clark, 2007; Lindstrom, 2005, p. 15). It is also the perfume of the Singapore Girl,

as the flight attendants are known. This fragrance is even used in the Singapore Airlines lounges and mixes indelibly in the minds of customers with the Asian-style music that is part of Singapore Airlines commercials (Linstrom, 2005, p. 113).

The use of fragrances in hotels and casinos is not a new phenomenon. Mark Peltier, owner and president of AromaSys, Inc., and a forerunner in the area of hospitality-setting fragrance use, completed his first hotel installation in June of 1991 at the Miami Marriott Dadeland. His first installation in a gaming property was at the Mirage, Las Vegas, Nevada, later that same year (personal communication, September 28, 2009). Since that time hundreds of casino and hotel owners and managers have chosen to use fragrances to enhance the guest experience, strengthen brand alliances (Jeffries, 2007), serve as a tool for wayfinding (“Trend Alert!” 2006), and to highlight certain specific areas such as the pool (Gross, 2007) or the spa (“Trend Alert!” 2006).

For example, the floral smell that guests detect as they enter the lobby of Bellagio Las Vegas and lures them into the flower-packed atrium, is coming through the air vents from a fragrance dispenser connected to the heating, air conditioning and ventilation (HVAC) system. The customers believe the flowers are creating the fragrance and the hope is that they are intrigued and delighted.

Guests at the Barona Valley Ranch Resort & Casino experience Cedarwood Spice, whether it is consciously or not. This fragrance is also dispensed through the HVAC (Soto, 2009). The Venetian in Las Vegas, Nevada uses a single signature fragrance called “Seduction” (Gilbert, 2008, p. 171).

The Hyatt Regency properties are all scented, but the upscale hotels in the chain have one-of-a-kind signature fragrances (Burr, 2006a). The Park Hyatt in Washington,

D.C., sports a custom fragrance developed by Blaise Mautin, a Parisian perfumer (Gross, 2007). At the Mandarin Oriental New York, candles are burned in the lobby releasing the scent of the hotel's signature Mandarin Blossom Tea (Burr, 2006b).

Morgan's Hotel Group has decided to use a different signature fragrance in each of its ten boutique properties. For example, Hudson New York, one of the chain's Big Apple properties, uses a fragrance that combines the scents of "cassis, raspberry blossom, red magnolia, blooming peony, jasmine and sheer musk" (Slaton, 2007, p. 17).

When Starwood's Westin hotel chain rolled out its ad campaign touting its new multi-sensory commitment to guest renewal, the tagline was, "This is how it should feel." Magazine ads even featured a scent strip that gave readers a preview of the White Tea fragrance that Westin introduced into its hotels (Watkins, 2006). This fragrance has become so popular, there are now White Tea products available for purchase for the home at many of the Westin properties (Slaton, 2007).

Another Starwood chain, Sheraton, had a signature scent created by MANE with scents of bergamot, jasmine, fig and freesia. The Dorchester Group Hotels has carried the branding even further by engaging experts to not only create custom fragrances for its London and Paris properties, but to develop candles and room sprays with the same fragrance to be sold at location boutiques ("Trend Alert!" 2006). Starwood's W and St. Regis lines have signature scents. W's scent is called Bling, and St. Regis properties fill the air with a blend of sweet pea, roses and a little tobacco. Both of these fragrances are disseminated using candles (Burr, 2006b).

The fragrance at Le Méridien Hotels, in a subtle way, honors the company's parent, Air France. The company's signature scent incorporates the smell of an old copy

of *Le Petit Prince*, by Antoine de Saint-Exupréy, a pilot. The musky book's fragrance was analyzed, captured and blended with other components to create the final scent (Burr, 2006b).

Many of the multi-use properties employ a variety of scents. Mandalay Bay uses a different fragrance in its casino in Las Vegas than the one it uses in the adjacent The Hotel. The Mohegan Sun in Uncasville, Connecticut uses as many as 12 different fragrances throughout its two adjoining casinos and hotel complex (Mark Peltier, personal communication, September 27, 2009). Travelodge properties allows guests to make their own choice of fragrances, offering in-room scent options including "sea," "freshly cut grass" and "baby powder ("Good Week," 2008).

Omni Hotel properties mix it up even more. Its lobbies feature a lemongrass with a hint of green tea fragrance (Sloan, Shriver & McCown, 2007) . The hotel pool areas are scented with coconut. Plus, the company has a program called Sensational Meetings that has different ambient settings designed to match desired meeting outcome. For example, people who come together for a high-energy brainstorming session might be surrounded with dramatic colors, citrus fragrances and be fed healthy snacks. A meeting that has the potential to be stressful or combative might be staged in a room with a green tea fragrance, relaxing music and lowered light levels to ease tension ("Omni Makes Good Sense," 2007).

The concept of fragrance use has become so popular that even the choice to not use fragrances is news, as some hotel chains have spurned the use of fragrances altogether. Hampton Hotels has a brand-wide commitment to a program called Non Scents, and has partnered with Proctor and Gamble to provide Febreze®, Linen & Sky™

to all of its housekeepers to eliminate guestroom odors (Cioffi, 2007; Watkins 2007). In a similar move, Wyndan Hotels has created a limited number of allergy-free rooms in some of its properties, promising that they will be free of allergens, odors, bacteria and other contaminants (Watkins, 2007).

As mentioned above, hoteliers and casino property owners are using fragrances to help establish their brand, (Gross, 2007; Jeffries, 2007; “Trend Alerts,” 2006:), enhance the ambience and heighten the experience of the guest (Gross, 2007), and to continue to impact the customer after he or she leaves the property as “the subtlest of our senses [smell] can also leave the deepest impression with consumers” (“Fragrance of Success,” 2006, p. 8). In addition to these uses, according to Sharon Sherwood, vice president and cofounder of Ball Ground, a Georgia-based company of EnviroScent LLC, fragrances are used in public spaces for “product promotion, to support a theme, ambience and creation/re-creation of memories, aromatherapy/aromachology, remediation” (Jeffries, 2007, p. 52).

Fragrance Sources and Aromatherapy

Ambient fragrances can be blended from synthetic raw materials (man-made, usually consisting of one molecule); natural raw materials (extracted from plant materials, usually consisting of multiple molecules) or a blend of natural and synthetic sources (Turin, 2006, p. 8). Natural raw materials, including essential oils (EOs) which are distilled or pressed from plant sources and contain a range of components, have been documented to affect the physical and mental well-being of individuals (Cooksley, 1996). Research is beginning to corroborate the claims of aromatherapists, that specific EOs can affect physical and emotional feelings.

Problem Statement

Use of Specific Targeted Fragrances

This study explores the concept of creating targeted fragrances, based on the tenets of aromatherapy and aromacology, to affect the physical and psychological feelings of casino customers to enhance their experience of the casino and encourage extended stay. For example, if casino managers want their customers to be “relaxed,” perhaps lavender essential oil could be included in the fragrance blend, as lavender has been documented as having a soothing, calming effect (Edwards, 1999, p. 27; Tisserand, 1977).

An example of targeted use of fragrances is evidenced by Omni Hotels with its “Sensational Meetings,” program mentioned above where soothing fragrances are used to calm and soothe potentially stressed meeting attendees and arousing citrus fragrances are used to stimulate meeting attendees who need to create or celebrate (“Omni Makes Good Sense,” 2007). Another example of this is in a Japanese office. The Kajima Corporation wafts an awakening citrus scent in the offices in the morning and after lunch, a calming floral scent mid-morning and mid-afternoon to increase concentration, and a woody scent at lunch and at the end of the day to encourage relaxation (“Aromacology,” 1990).

Experiment Design

The experiment design was modeled after the work of Hirsch (1995), who placed fragrance machines in two areas of a Las Vegas casino over a weekend. He reported a 45% increase in coin-in for one of the fragranced areas, over the coin-in for the same area the weekend before and the weekend after the experiment (Hirsch, 1995).

There were several issues with Hirsch's study. First, he never published a list of the components of the fragrances that were used, so his findings could not be tested on that point. Second, his experiment only lasted 48 hours. Third, the dates of the experiment were not disclosed. If the experiment had been conducted during a holiday weekend or on a weekend where one or more special events were being held on the property or in town, increased traffic rather than the fragrance could have been responsible for the increased coin-in for that period.

The experiment for the current study was conducted in a large United States casino over a period of 20 days starting in June 2007 and ending in July. During that time, four fragrances—two refreshing or uplifting fragrances and two soothing fragrances—were diffused in five different slot machine locations within the casino for four 24-hour periods each, with a fifth non-scented control element included in the rotation. The rotation of the fragrances throughout the five locations eliminated any question of popularity of location, ease of access (e.g., at the end of an aisle) and popularity of machines. The fragrance dispensing equipment was the same as that used in the Hirsch study (M. Peltier, personal communication, March 2007). Coin-in was used as the quantifying factor to compare the efficacy of the fragrances in effecting coin-in in relation to the control setting and to more than two months of coin-in data for the same machines prior to the experiment (referred to throughout this document as “pretest data”).

Research Questions

The experiment will address the following research questions:

1. Will fragrances affect the experience of slot machine customers to the extent that they either extend or curtail their length of play at the machines resulting in increased or decreased coin-in?
2. Will refreshing/arousing fragrances affect the experience of slot machine customers to the extent that they either extend or curtail their length of play at the machines resulting in increased or decreased coin-in?
3. Will soothing/calming fragrances affect the experience of slot machine players to the extent that they either extend or curtail their length of play at the machines resulting in increased or decreased coin-in?
4. Do fragrances with predominately natural components have the same effect on slot machine players in relation to length of stay at the machine as fragrances with predominately synthetic components?

Hypotheses

The study's research hypotheses are as follows:

H1: An ambient fragrance in the casino will affect the coin-in of slot machines.

The fragrance literature considers the fact that some fragrances will exert a more stimulating effect and others will have more of a soothing effect. Past research has found that these effects can result in different types of behavior. In the casino environment a more stimulating fragrance may help a gambler stay at a machine longer and play more

money. Alternatively, a soothing fragrance may help relax the gambler and lessen the impact of the exciting environment and allow the gambler to play longer.

H2a: An ambient stimulating/refreshing fragrances will result in more money spent at the slot machines than if a soothing fragrance or no fragrance was present. H2b: An ambient soothing fragrance will result in more money spent at the slot machines than if a stimulating/refreshing fragrance or no fragrance was present.

Companies can use fragrances derived mainly from essential oils or less expensive synthetic blends. The majority of the research indicating that fragrances impact behavior has employed fragrances derived from essential oils. However, synthetic fragrances are said to be (and smell) equivalent to essential oils.

H3a: A fragrances formulated with a high percentage of natural components or essential oils will result in more money spent at the slot machines than will a fragrance formulated predominately from synthetic materials. H3b: A fragrance formulated with a high percentage of synthetic components will have the same effect on money spent at slot machines as a fragrance derived from a high percentage of natural components or essential oils.

Significance of the Study

The results of the study and experiment are significant in that they provide hotel and casino owners and managers with decision-making tools to: a) choose whether to use ambient fragrances at all; b) decide whether to solely pursue the marketing aspect of fragrances and their abilities to engender brand loyalties (Jeffries, 2007; Lindstrom, 2006); and c) decide whether to create and use ambient fragrances that address the

desired psychological feelings of their guests. This study also adds to the growing body of research on the efficacy of fragrance use in a broad range of public settings to effect various responses from staying longer in a location (Jeffries, 2007) to enjoying the experience (Nelson, 2009).

Definitions of Terms

Aromachology: “. . . the scientific analysis of olfactory effects on mood, physiology and behavior” (Herz, 2009, p. 271). The term was coined in 1983 by the Sense of Smell Institute. For research to be considered “aromachology,” it must meet five requirements including hypothesis testing, experimental methodology, subject populations that are sufficient and representative and that include control groups; statistical analysis of data; and reports that are peer reviewed and appear in reputable journals (Herz, 2009).

Aromatherapy: “The skilled and controlled use of essential oils for physical and emotional health and well-being” (Cooksley, 1996, p. 3).

Coin-in: The amount of money put in a machine for gambling or gaming purposes.

Essential Oils: “. . . tiny droplets contained in glands, glandular hairs, sacs, or veins of different plant parts: leaves, stems, bark, flowers, roots and fruits. They are the ‘essence’ of that particular plant form” (Cooksley 2002, p. 4). The essences of the plants are extracted using a distillation method or by pressing (Lawless, pp. 36-37). Essential oils will be referred to throughout the document as “EOs.”

Synthetic Fragrance: A man-made fragrance, often consisting of a single molecule (Turin, p. 8). Synthetic fragrances will be referred to throughout the document as “synthetic fragrances,” or “synthetics.”

Summary

Although fragrances are being used throughout the hospitality industry for many reasons, the question remains, “Are fragrances being used as effectively as possible to enhance the guests’ experience?” This question will be addressed by looking at coin-in in a large United States casino in relation to fragranced and non-fragranced banks of slot machines. The following literature review, taking into consideration information from a range of disciplines, will provide the concepts for the basis of the experiment described in Chapter 3.

CHAPTER 2

LITERATURE REVIEW

Introduction

Fragrances from flowers, incense, perfumes, unguents, natural oils, and the smoke from burning plant parts have been used for thousands of years to attract members of the opposite sex; create special moods; worship gods; heal mental, emotional and physical illnesses; and encourage meditative states (Ackerman, 1990, pp. 6-62). The use of fragrances in the hospitality industry, and in casinos in particular, started in the early 1990s (M. Peltier, personal communication, September 29, 2009).

The purpose here is to place the concept of using essential oils, or a mix of synthetic and natural fragrances, specifically to enhance the experiences of casino patrons within an inclusive framework of history and research. This will begin with information on the physiology of the sense of smell, and move through the history of fragrance use, and the nature of essential oils and synthetic fragrances. Then medical and research evidence of the effects of fragrances on human behavior will be examined, followed by a discussion of ambient environments and atmospherics, concluding with research on the use of fragrances in retail, hospitality and other public settings. The research comes from the areas of retail, marketing, psychology, holistic and allopathic medicine, aromatherapy, aromacology, education, food and beverage management, hotel management, gaming, and tourism. The research is presented in six sections as outlined below.

The first section explores the many theories on the human sense of smell. There is acceptance of the fact that the sense of smell is decoded in the limbic portion of the brain,

but as to how the transfer from the chemical inhaled through the nose translates to the recognition of the smell is not universally agreed upon. Here will also be a discussion of the different opinions as to how fragrances motivate people to action. Is it subconscious, based on memory and emotion? Is it simply mood? Or is it a cognitive decision-making process based on a myriad of inputs? These issues become important as we consider the best methodology for measuring fragrances' impact on casino patrons' behavior.

The second section briefly addresses the use of fragrances throughout history. Placing the use of fragrances in a casino within a historical continuum of fragrance use shows the precedence, and perhaps acceptability of such an action.

The third section discusses the properties of essential oils and the specific differences between natural and synthetic fragrances. Because the experiment employs both natural and synthetic fragrances, it is important to understand their differences and specific strengths. Also covered are the methods for using essential oils by aromatherapists and others in clinical settings.

The fourth section delves into the medical and research evidence of the effectiveness of using fragrances in a variety of ways from palliative care to calming patients in the waiting room of a dental office. This section also examines the ways that fragrances have been shown to alter human behavior.

The fifth section examines in detail the effects of the ambient environment or servicescape on customers and guests. There is a growing body of research on this topic. Fragrance is only a small piece of the many factors that contribute to a servicescape that include among other things, décor, level of customer service, and cleanliness (Bitner, 1992). These contextual factors can be found to influence how consumers perceive and

remember their experiences (Carbone, 2004; Hoch & Deighton, 1989). It is important to look at the servicescape as a whole to better understand the impact of the ambient surroundings on the individual.

The sixth section looks at the use of fragrances in a variety of public settings, including restaurants, hotels, and casinos, while concentrating on retail stores and malls. A casino is similar to a retail environment because the customer must be engaged in the “purchasing” process, or “gaming process” in the casino, after he or she is inside the building. This is unlike leisure settings such as sporting arenas, museums or theme parks where the customer makes the main purchase at the door to gain entry to the event or facility.

There is a great deal written on fragrances in relation to memory elicitation, emotions, branding and marketing opportunities. However, these subjects are not specifically addressed in detail as they are not within the scope of this study.

The Human Sense of Smell

The Physiology of Smell

Human beings experience the world exclusively through the five senses of taste, touch, hearing, vision and smell. There is no other option, there is no other way to *be* in the world. These senses literally “define the edge of consciousness,” (Ackerman, 1990, p. xv).

Of the five senses, smell is possibly the least understood. There is agreement among scientists about the way the brain perceives visual images: photons hit the retina in the eye where special cells called rods and cones change that impact into electrical

impulses that travel up the optic fiber to the visual cortex, a well understood part of the brain. There the electrical impulses are translated into what is recognized as a visual image (Anissimov, 2009).

The awareness of having touched something, feeling the wind, or experiencing pain from a pinprick, or changes in temperature is because of the existence of thousands of encapsulated nerves located between the dermis and epidermis layers of the skin (Ackerman, 1990, p. 83). These nerves or receptors come in different shapes and sizes and help decode stimuli into touch, temperature, pressure and pain. The messages from these receptors travel via nerve fibers to nerve cells in the spinal cord which send the message even further to the thalamus in the brain and ultimately to the somatosensory cortex, the touch center of the brain (Murphy, 2003c, pp. 25-27).

Sounds are experienced due to vibrations in air molecules that in turn set up vibrations in the inner ear that are translated into readable data by the brain. Sound waves are created by voices, the ocean as it crashes on the shore and MP3 players. Sound waves are caught by the outer ear and travel up the auditory canal to the eardrum or tympanic membrane causing it to vibrate. This vibration causes three bones in the middle ear to also vibrate which in turn, start a vibration in the inner ear's cochlea. It is the cochlea that translates the vibrations into nerve impulses that travel up the auditory nerve to the auditory cortex in the brain (Murphy, 2003a).

Taste is related to smell, in that the sense of smell heightens the sense of taste by adding dimension to the five taste categories detectable by humans: sweet, salty, bitter, sour and umami (Gilbert, 2008, p. 91). The bumps on the tongue, known as papillae contain the taste buds, some only one taste bud and some as many as 250 (Murphy,

2003b, p. 17). Specific places on the tongue reveal different tastes. For example sour tastes are detected at the sides of the tongue, whereas salty tastes are detected throughout the tongue, and sweet tastes are recognized by the tip of the tongue (Ackerman, 1990, pp. 138-139). As one chews, saliva breaks down the chemicals in the food which rest in the taste buds, setting off vibrations of nerve cells and tiny hairs. The vibrating nerve cells send out messages to the parietal lobe of the cerebral cortex. Of all the senses, the distance from the source of the stimulus to the brain is the farthest for the sense of taste (Murphy, 2003b, pp. 22-25).

In contrast, the sense of smell has the shortest distance from the source of the stimulus to the brain. In fact, the neurons that make contact with the chemical molecules and send messages to the brain, actually dangle in the nasal cavity, open to the air. Ackerman (1990, p. 10) calls smell, “the most direct of all of our senses.”

There is basic agreement that scent molecules enter the nasal cavity with an inhalation, and that receptors at the base of tiny hairs called cilia translate the contact with the molecule into an impulse that goes straight to the limbic system where it is decoded and a “smell” is noted (Ackerman, 1990, pp. 10-11). What is not understood is what makes a molecule fragrant. Some say it is the shape of the molecule that fits in specifically shaped receptors that therefore register the molecule as having a certain fragrance (Ackerman, 1990, pp. 13-15). In 1996, Lucas Turin proposed a different theory. Based on discoveries he himself had made and the work of R. H. Wright in 1997 and Malcolm Dyson in 1938, he suggested that the molecules have specific vibrations, and that those vibrations are recognized and decoded by the receptors in the nose (Minkel, 2006; Tisserand, 1977, p. 64; Turin, 2006; Watkins, 2009). In 2006, physicists agreed

that there was some plausibility to this theory but they still didn't understand the mechanism and detailed structure of the receptors themselves (Minkel, 2006).

When stimulated with an odor, the limbic system releases certain neurotransmitters that spread throughout the body. Based on which fragrance is detected, the neurotransmitters released can include encephaline which reduces pain and produces pleasant sensations; endorphins which also reduce pain and excite sexual arousal; serotonin which helps one relax and sleep; and noradrenaline which has stimulating properties and can keep one awake (Fischer-Rizzi, 1990, p. 27).

The Lowly Sense of Smell

The sense of smell, in addition to not being fully understood, is sometimes somewhat maligned. The sense of smell, as stated before, takes place in the limbic portion of the brain. This is known as the old brain, as it was one of the first portions of the human brain to develop (Fischer-Rizzi, 1990, p. 26). It is perhaps because of this, that the sense of smell has been named by some to be the least important of our senses. In addition, some scientists have hypothesized that as man began to walk erect, and the nose moved away from the ground and its accompanying odors, the sense of smell became less important to survival. It is also thought by many that humans have the poorest sense of smell of all mammals (Ackerman, 1990, pp. 31-32).

It is true, that mice, for example have 1,100 functioning olfactory receptor genes at the high end (Shepherd, 2004) compared to humans with only 350 at the low end (Gilbert, 2008, p. 91; Shepherd, 2004). However, these assumptions fail to take into account several factors including the capacity of the human olfactory brain and the human capacity for language, among other things. In actuality, humans perform as well

as dogs on certain olfactory tests, and can out perform a gas chromatograph in tests of odor detection (Shepherd, 2004).

The ability to smell, or detect and identify odors, varies with the person. Smelling talent is rated on one's ability to detect a smell at a low concentration, discriminate among different smells, and identify specific smells by name. Some people are unable to smell at all. These people are said to have anosmia. This state can exist from birth or be brought about by sinus infections or blows to the head, among other causes. People with hyposmia can barely perceive odors. Other aberrant smell states include phantosmia where one imagines smells with no identifiable source; parosmia where an actual odor is misinterpreted, usually as something foul, malodorous (Gilbert, 2008, pp. 48-52); and synesthesia where the senses are confused and a smell can be experienced as a color, a sound registers as a temperature, or a taste is perceived as a pebble (Kher, 2009).

The ability to smell also varies with the gender and age of a person. Tests have shown that women have a better sense of smell than men. This is both in identifying odors and in detecting the existence of an odor (Gilbert, 2008, p. 53). It is also been shown that the sense of smell is strongest between the ages of 20 and 40 and it is strongest at night (Cooksley, 1996, p. 13).

Smelling cannot be avoided, without a filtering apparatus, because it comes with each breath, and breathing is required for life. One can, for the most part, refuse to participate in the other senses by closing his or her eyes, avoiding food, blocking out sound and shunning touching or being touched. The sense of smell is an integral part of our life experience.

Protected by the Sense of Smell

Fragrances not only provide pleasure, they provide protection. Putting food in the mouth places it right under the nose where it is unconsciously examined for freshness and edibility. The smell of smoke alerts one to danger. According to Brumfield, Goldney and Gunning (2008):

The human brain is hardwired to sense impending danger from fire, rancid materials, harsh chemicals, smelly people, and wild animals. When we detect these odors, they automatically signal the body's "fight or flight" to respond with adrenaline, speeding heart rate, increased respiration, and other physiological changes. In the ensuing hyper aware state, we immediately seek safety or get ready to rumble (Brumfield et al., 2008, pp. 77-78).

The chemical, ethyl mercaptan, is added to propane, an odorless, explosive gas, to alert people to leaks. Other ways to use scent as a warning system are being studied, including fragrance-releasing fire and burglar alarms to alert deaf persons of impending danger, among others. Brumfield sees a day when bank robbers will be sprayed with a scent that screams "thief" to anyone they pass, public emergency and warning systems will be supplemented with warning fragrances, and deteriorating parts will warn owners of safety concerns as fragranced interiors are reached (Brumfield et al., 2008, pp. 78-86).

Fragrances and Human Behavior

There are many different theories about the effects of fragrances on human behavior ranging from a subliminal, uncontrollable power (Brumfield et al., p. 6-7) to a

physiological reaction, to a psychological reaction, or a combination of all three (Herz, 2009).

The interest in the power of subliminal cues has come and gone throughout history. In 1957, a man named James Vicary advertised that he had placed subliminal messages onscreen in a movie theater, raising the sales of Coca-Cola and popcorn by 18.1% and 57.7% respectively. Shortly thereafter, he admitted to having fabricated the entire story. In 1973, Wilson B. Key theorized that sexually oriented and arousing images were in print advertising, however his studies did not stand up to scientific scrutiny. Perhaps the most recent wave of interest was in the 1980s and 1990s with the advent of subliminal self-help audiotapes that could help one lose weight, stop smoking or gain self esteem (Gilbert, 2008, pp. 178-180). There is evidence that people do experience odors and other stimuli on a subliminal or subconscious level, but the evidence of uncontrolled, unconscious actions based on urges is not corroborated (Gilbert, 2008, p. 180). The research relating to congruence indicates that a fact-related decision is made at some level before an action is taken. This is evidenced in the research by Spangenberg, Sprott, Grohmann & Tracy (2006) who showed that sales of women's clothing and accessories went up when a feminine fragrance was diffused throughout the store and the sale of men's clothing and accessories went up when a masculine fragrance was ambient (Spangenberg et al., 2006). Another study, looking at the congruence of fragrances and music, showed a similar response. Mattila and Wirtz (2001) found that shoppers' evaluation of a store was higher when fragrance and music was congruent—arousing music and arousing fragrances, or calming music and calming fragrances—than when the fragrance and music did not match (Mattila & Wirtz, 2001).

The physiological reaction to EOs and other fragrances has been documented (Herz, 2009). An example of this is the study by Shina et al., (2007), that found that simply inhaling lavender EO could reduce cortisol levels in the blood, enhance blood flow and increase relaxation. Another study using an EEG, and a specific test called the contingent negative variation, or CNV, looked at 20 EOs and their effects. For most of the EOs, the results indicated that the EOs produced changes that reflected their traditional aromatherapy properties (e.g., lavender as calming and jasmine as sedating). However, a subsequent test by another group indicated that the CNV response might be partly due to expectations about an odor, indicating a psychological response (Herz, 2009).

“The psychological hypothesis proposes that odors exert their effects through emotional learning, conscious perception, and belief/expectations” (Herz, 2009, p. 276). This concept takes into account developmentally engendered feelings for fragrances based on culture and experience and personal likes and dislikes of certain fragrances. The most probable explanation for human responses to fragrances is a combination of subliminal, physiological and psychological reactions to an odorant.

The History of Fragrances

Fragrances have been used for thousands of years in religious ceremonies, meditation, healing practices, and as purifications and cosmetics (Worwood, 1995, p. 19; Damian & Damian, 1995, p. 3). These fragrances were used to effect change whether it was to intensify a religious experience by arousing the senses (Damian & Damian, 1995,

pp. 3-4), cure a patient of a fever or ailment with fumigation, or embalm a king (Tisserand, 1977, p. 2).

On a clay tablet, thought to be from early Babylon dating back to 1800 B.C.E., was written an order for, “imported oil of cedar, myrrh and cypress” (Tisserand, 1977, p. 22). This indicates an early knowledge and trade of fragrance oils. It is important to note that the oils used in ancient times were not the pure EOs in use today, which are usually extracted from plant materials using a distillation process. These oils were created by soaking the plant materials in a base oil of some sort, possibly olive or sesame oil, placing them in the sun and allowing them to infuse for several weeks. This is a process known as maceration. In the instance of flower fragrances, flower petals were placed in animal fats, which absorbed the fragrances. This process was known as enfleurage and is still in use to some degree today (Wildwood, 1996, p. 2; Kelville & Green, 1995, p. 2) as that is the only way some flowers, such as jasmine will release their fragrances (Battaglia, 2005, p. 34).

The Egyptians made elaborate and systematic use of fragrances. Over 3,500 years ago, they were using plants for medicine, healing massage, surgery, food preservation and mummification (Damian & Damian, 1995, p. 4). Fragrances were used in personal perfumes and cosmetics and in religious rituals in the form of incense. Fragrances were so important that men and women would wear cones of fragranced oil on their heads that would slowly melt throughout the day or evening event, coating their heads and bodies in smell (Davis, 1995, p. 2; Tisserand, 1977, p. 23).

The Greeks and Romans took up these practices, adding traditions of their own including fragranced baths and daily massages with fragranced oils (Lawless, 1992, pp.

12-15). The Romans' love of the rose and its fragrances was celebrated in a dedicated holiday, Rosalia. Nero is said to have given a banquet where he installed silver pipes beneath the plates to spray the guests with fragranced waters between the courses. The ceiling in his banquet hall could open, raining flowers and perfume on the guests below (Ackerman, 1990, p. 36).

In the more practically oriented East, fragranced oils and specific unguents were referenced in Vedic and Chinese healing texts that are still in use today (Damian & Damian, 1995, pp. 3-4).

The distillation process we know today was fully developed, or perhaps rediscovered, around 1000 C.E. by a physician, 'Abu 'Ali al-Husain Ibn 'Abd Allh Ibn Sina, known as Avicenna, born in what is now Uzbekistan (Damian & Damian, 1995, p. 6). With the advent of distillation, fragrant oils could be easily extracted from the source plant materials and created in quantity. There was soon a market for rose water and other Arabian scents (Lawless, 1992, p. 14).

Rediscovered may be the term for Avicenna's contribution, as still-like apparatus dating back to 3,000 B.C.E. was found in an area that is Pakistan today. Another 3,000-year-old, still-like device was found in Afghanistan, and 13th to 12th century B.C.E. cuneiform tablets depict vessels containing coils that resemble the Arab *itriz* used much later for distillation (Kelville & Green, 1995, p. 2).

Aromatic oils were used in the 14th through 16th centuries as medicines and were created in apothecaries or in home stillrooms (Kelville & Green, 1995; Tisserand, 1977, p. 34). Bubonic plague struck throughout the Middle Ages, but was perhaps at its worst in 1722. It was thought that the stench of the disease—horrible breath that smelled of rotting

flesh—should be combated with sweet smells. Fires of pine and other odiferous woods were burned in the streets; houses were fumigated with incense and perfumes. Reports from that time indicate that those most closely associated with the aromatics, especially the perfumers, appeared to be virtually immune to the disease (Damian & Damian, 1995, p. 10; Tisserand, 1977, pp. 38-39; Wildwood, 1996, pp. 4-5)

A distinction evolved between perfumers and apothecaries by the end of the 16th century (Lawless, 1992, p. 15), and it was in 1799 that the first man-made, synthetic fragrance molecule was created and recorded (Turin, 2007, p. 33). Thus, it is the middle of the 16th century that marks the downturn of the use of aromatic oils and herbs for healing purposes as the interest in chemical medicines grew.

It was not until the late 1920s, when Rene-Maurice Gattefosse, a French perfume chemist, started publishing on the healing properties of essential oils that interest was regenerated. He found that many of the essential oils he was using for fragrance in his cosmetic mixtures were better antiseptics than some of the chemicals he was using. In addition, he became very interested in the healing properties of lavender after he stuck his burned hand into a container of neat lavender and was surprised to find it healed quickly with little scarring and no infection. Gattefosse was the first to use the word “aromatherapy” to describe the use of essential oils as tools for healing (Damian & Damian, 1995, pp. 11-12; Keville & Green, 1995, p. 7; Tisserand, 1977, pp. 40-43). Today, aromatherapy is defined as the “skilled and controlled use of essential oils for physical and emotional health and wellbeing (Cooksley, 2002, p. 2).

Dr. Jean Valnet, another luminary in essential oil use and research, was inspired by Gattefosse’s work and used EOs to treat wounded soldiers in World War II. He went

on to use EOs to treat psychiatric and other disorders. His book, *Aromatherapie*, published in 1964 is still a trusted medical reference (Damian & Damian, 1995, pp. 11-12; Kelville & Green, 1995, p. 7; Tisserand, 1977, pp. 40-43).

Margaurite Maury, one of Valnet's many students added her own touch to the growing body of knowledge of EOs. She wasn't comfortable administering essential oils orally, and wanted to use another method for people to assimilate the oils. She was responsible for reviving the use of essential oils in massage therapies—like the Egyptians almost 3,500 years earlier—and added the concept of using the oils up and down the back on either side of the spine. She also promoted the idea of creating blends of EOs specifically for each client, based on his or her unique symptoms, personalities and needs. Maury won two international prizes for her research (Wildwood, 1996, p. 6).

Today EOs are used throughout the world not only in health care, but in food science, the cosmetics and perfume industries, and hospitality settings (Cohen, 2001). In Europe and Australia, essential oils are used in a more clinical mode than they are in the United States where almost all aromatherapy use is in the form of complementary alternative medicine therapies or CAMs as they are known (Thomas, 2002).

Essential Oils and Synthetic Fragrances

The Nature of Essential Oils.

Essential oils are the lifeblood of aromatic plants, trees, and bushes. They are highly complex and potent compounds with healing properties for the body, mind and emotions (Cooksley, 2002, p. 17; Damian & Damian, 1995, p. 3). Essential oils are found in various parts of plants or trees including leaves, branches, fruits, roots, stems, nuts,

seeds, bark, flowers, buds, and resin (Cooksley, 2002, p 4; Worwood, 1995, p. 2). For example, an orange tree produces three distinct EOs. From the flowers, neroli is obtained. Sweet orange is pressed or expressed from the peel of the fruit itself, whereas petitgrain, is produced by distillation of the leaves and twigs (Wildwood, 1996, pp. 270-277).

True EOs are either distilled or released from the plant by pressing, also known as expression (Cooksley, 2002, p. 7). Essential oils are complex blends of chemical components including terpenes, aldehydes, phenols, ketones, oxides, alcohols, and esters (Edwards, 1999, pp. 56-62; Wildwood, 1996, pp. 13-14). Some EOs have hundreds of different chemical components, and depending on the chemical makeup, each EO has specific healing properties. For example, different types of alcohols such as linalool, found in lavender; citronellol found in rose, lemon, eucalyptus and geranium; and gerinol, found in geranium and palmarosa “tend to have good antiseptic and antiviral properties and an uplifting quality” (Wildwood, 1996, p. 14). In this manner, most oils are more or less antiseptic, antiviral, and antibacterial (Damian & Damian, 1995, p.10, 13-14, 51-55).

Clinical Use of Essential Oils

Unlike allopathic medicines, EOs are typically not taken orally as this is the “least effective method of taking EOs because it involves passing the substance through the digestive system where it comes into contact with food and bacteria with which it could chemically interact” (Worwood, 1991, p. 2). However, oral use of EOs is not totally unheard of, and is practiced mainly in Eastern Europe.

Essential oils are also used in very small amounts as they are extremely concentrated. One drop of chamomile EO is said to be the concentration equivalent of 30 cups of chamomile tea (Cooksley, 2002, p. 4).

Most EOs are either applied to the skin, often in an aromatherapy massage, absorbed through the skin during an aromatic bath, or inhaled with the oils made available using a diffusers. Because EOs are very strong and can damage the skin if applied “neat” or straight, a range of carrier oils are used in the massage process, many of which have healing properties of their own. Essential oils have a molecular structure that allows them to be absorbed into the skin and enter the bloodstream through the pores and hair follicles (Gray, 2006; Wildwood, 1996, p. 10) where they are absorbed by capillaries. The essential oil components are then delivered throughout the body and excreted easily after a period of time (Cooksley, 1996, p. 16). Some oils are absorbed quicker than others. For example eucalyptus and thyme reach the system within half an hour, and coriander and peppermint may take up to two hours to reach the system. A classic experiment that shows the permeability of the skin is to rub a piece of garlic on the bottom of one’s foot and note the experience of the taste of the garlic within a short period of time (Wildwood, 1996. P. 10).

The active components, such as the terpenes, aldehydes, etc., discussed above are very volatile in that they are easily released into the air. When EOs are diffused into the air via an electronic diffuser, lamp ring, or other device, one inhales the components with each breath. Once in the lungs, the components move into the alveoli with oxygen and are then introduced into the bloodstream through the capillaries and distributed throughout the body (Cooksley, 1996, pp. 12-18).

Books on aromatherapy usually include an introduction to aromatherapy, information on how to safely use EOs, and history on the subject. Some books are similar to cookbooks in that they have a list of physical and emotional issues or symptoms with “recipes” that includes specific EOs and oil blends to help alleviate the problem. An example of this is found in Worwood’s book (1991), *The Complete Book of Essential Oils and Aromatherapy*. Under “Loss of Memory,” Worwood recommends a blend of basil” (8 drops), grapefruit (10 drops), lavender (7 drops and rosemary (5 drops)” (p. 82) in a carrier oil to be inhaled, applied to the temples and neck and sprayed around the room from a spray bottle (Worwood, 1991, p. 51) to provide an aid in remembering things that happen throughout the day.

Other books contain an alphabetical listing of the EOs themselves and include information on the EOs’ specific properties. For example, Battaglia (2005), discusses in great detail about each of the EOs he lists, including the “botany and origins,” “essential oil characteristics,” including the color and odor of the EO, “historical and traditional uses,” and the EOs’ effects on various parts or systems of the body. He cites palmarosa, an EO with a floral fragrance, as “. . . extensively used in skin care. It is antiseptic, has hydrating properties, helps to balance sebum production and is reputed to stimulate cellular regeneration” (Battaglia, 2005, p. 243).

Synthetic Fragrances

As mentioned above, the first synthetic fragrance molecule was created in 1799 (Turin, 2006, p. 33) and since that time more than eight million synthetic fragrance molecules have been developed in the laboratory. Some of these molecules smell like

things one would recognize such as lemon, apples, truffles, while others have smells that are unrecognizable (Turin, 2006, p. 17).

Although many have condemned the use of synthetic fragrances, they do play an important role in cosmetics, household cleansers and laundry items, deodorizers and even perfumes. Synthetic fragrances serve three purposes. The first of these is standardization. Fragrances from natural sources smell differently based on the source plant's soil conditions, time of year it is harvested, annual rainfall, and other growing factors (Tisserand, 1977, p. 14; Turin, 2006, p. 23). In contrast, synthetic molecules do not change: a synthetic molecule of vanilla always smells the same because the chemical makeup never changes (Turin, 2006, p. 47).

The second purpose for synthetic fragrances is that they are much less expensive than fragrances from natural sources. For example, coumarin, a synthetic ingredient in many perfumes, was developed to serve as a tonka bean fragrance equivalent. The cost of a kilo of coumarin is 10 Euros, whereas the cost of a kilo of tonka bean absolute costs approximately 400 Euros (Turin, 2006, p. 23).

The third reason for synthetic fragrances is diversity. Perhaps one could blend the precise mix of natural ingredients to create some of the popular fragrances such as, Glade®'s "Fresh Mountain Morning™" or "Clean Linen™," but it is much easier, not to mention more cost effective, to use a synthetic fragrance.

Behavioral, Psychological, and Physiological Reactions to Fragrances

Introduction

Research has been conducted on the use of aromas to effect change in human behavior and responses due to the psychological and physiological effects of the fragrances. This research has been conducted for a number of reasons, including the facts that fragrances are easy to use, have no side effects, are inexpensive, non-toxic (McCaffrey, Thomas, & Kinzelman, 2009), non-invasive (Itai et al., 2000), are quickly eliminated from the body (Worwood, 1991, p. 6), and are pleasant to experience.

These studies range from using aromas to lessen the anxiety of patients in a dentist's waiting room (Lehrner et al., 2005) to testing the efficacy of EOs as an alternative to prescribed drugs for crisis management in a residential treatment center (Fowler, 2006), to studying whether the use of EOs helps improve performance on physical and cognitive tests (Moss, Cook, Wesnes, & Duckett, 2003). Although a wide range of research in this area was reviewed, it is evident that additional research remains to be done as much of the evidence is anecdotal, especially in the area of health care (Cohen, 2001; Thomas, 2007).

Essential Oils and Anxiety or Stress

Several studies specifically address the use of EOs to calm and de-stress patients before—and sometimes after—visits to the doctor, simple procedures and surgery. For example, a trip to the dentist rates as one of the top ten fears, and can cause untold anxiety and avoidance behavior, where people do not visit the dentist at all (Cohen, 2001). Cohen (2001) reviewed the literature on the use of a combination of aromatherapy and music therapy for reducing pain perception and anxiety in relation to dental hygiene.

The essential oil of clove, known as eugenol has long been used in dental offices to provide pain relief, but the use of EOs to improve the patient experience is now being explored. Cohen suggests targeting oils to patient needs: including them in carrier oils for massage to reduce the discomfort of temporomandibular joint problems; placing a drop of a relaxing oil on the patient's bib to reduce anxiety; using a room diffuser to provide a pleasant scent (Cohen, 2001).

A study was conducted in a dentist's office showed that EOs of lavender and orange lowered patients' anxiety, improved their mood and raised their level of calmness (Lehrner et al., 2005). According to the researchers, Lehrner et al., (2005), "this finding is consistent with a growing body of evidence showing that odors are capable of changing emotional states in humans (Lehrner et al., 2005, p. 94)."

A similar study was conducted with 14 women who were receiving hemodialysis treatments. Using the Hamilton rating scale for depression (HAMD) and the Hamilton rating scale for anxiety (HAMA), results show that hiba oil "significantly decreased the mean scores of HAMD and HAMA, and lavender aroma significantly decreased the mean scores of HAMA" (Itai et al., 2000).

The healthcare setting is not only anxiety-producing in the patients, there is stress on the medical professionals as well. One study showed that aromatherapy massages combined with music significantly reduced the anxiety levels of emergency room nurses as measured by pre- and post-test data using the Perceived Occupational Stress Scale. However, it is important to note that the aromatherapy oils were not included in the massage oil as is usually the case, instead it was sprayed above the heads of the massage recipients prior to each intervention indicating inhalation of the oils rather than

absorption through the skin. It should also be noted that there was no control group where no aromatherapy sprays were used or where no music was played (Cooke, Holzhauser, Jones, Davis, & Finucane, 2007). Another study of nurses in relation to stress, indicated that a blend of the EOs, *Lavandula angustifolia* (lavender) and *Salvia sclarea* (clary sage), administered topically reduced stress according to subjective surveys (Pemberton & Turpin, 2008).

Test taking is another stress-inducing experience. Sometimes these stresses can be so prevalent, and the resulting anxiety so great that it results in “. . . mental distraction, difficulty with memory recall, and physical symptoms such as nausea, diarrhea, headache and a quickened heart rate” (McCaffrey et al., 2009). Forty nursing students at Florida Atlantic University participated in a study involving aromatherapy as a tool for reducing test-taking anxiety. Inhalers of lavender and rosemary EOs were used in the study. Before and after taking an examination, students completed a 10-item survey that evaluated current stress. In addition, blood pressure and radical pulse measures were taken before and after the examinations were given. Results indicated that both rosemary and lavender oils significantly reduced anxiety levels based on the survey. Blood pressure, which changes slowly, did not show any significant change when students used either the lavender or rosemary inhalers. However, radical pulse, which is an indicator of immediate stress and anxiety, was significantly lower than the pre-test pulse rates and the pulse rates of students with no aromatherapy interventions. This study indicates that lavender and rosemary can be effective in relieving test-taking anxiety (McCaffrey et al., 2009.).

Essential Oils and Cognitive Performance

The possibility of using EOs to enhance cognitive performance is of interest for healthy individuals who require focus and attention at work or when taking tests, and for individuals with dementia or other cognitive deficits. Several studies reveal that EOs are effective in improving cognition.

After reviewing 18 studies that met all of the requirements of aromacological research, Herz (2009) found “that various odors can significantly affect mood, cognition, physiology and behavior.” It is important to note, that she felt that the results were predominately because of psychological rather than physiological reasons, because *perception* (researcher’s emphasis) of the odor was important to the subjects and because, although some studies had similar results, specific chemicals could not be assigned to the various reactions as a range of fragrance sources were used including EOs, synthetic fragrances, and isomeric molecules (Herz, 2009).

Salvia officinalis, or sage as it is commonly known, has been used for thousands of years in traditional cultures and was thought to strengthen the senses and memory (Lawless, 1992, p. 164). A study using the EO of another species of sage, *Salvia lavandulaefolia*, was conducted with 24 healthy volunteers where two different oral doses of the EO were administered on different occasions. Participants took multiple cognitive tests and were rated on a variety of factors. This study used a “. . . placebo-controlled, double-blind, balanced, crossover design” (Tildesley et al., 2004). The results indicated that “speed of memory” scores increased after ingestion of the EO and there was an improvement on the “second memory” factor. In addition, mood was enhanced with

respondents reporting increases in “alertness,” “calmness,” and “contentedness” (Tildesley et al., 2004).

Researchers Moss et al., (2003) conducted a study of the effects of EOs of rosemary and lavender on cognition and mood. They reported, “We have demonstrated that the inhalation of ambient aromas of can significantly affect aspects of cognitive performance” (Moss et al., 2003). In addition, their results showed that rosemary significantly increased alertness and contentedness whereas lavender reduced contentedness.

Another study tested the EOs of ylang ylang and peppermint in relation to cognitive performance. Ylang ylang is a flower from a tree found in Asia and is traditionally known to have calming and sedative properties. Peppermint is an herb native to the Mediterranean area and is good for headaches and nervous upsets (Tisserand, 1977, pp. 288-289, 269-273). Participants reported increased calmness with the ylang ylang condition as compared to both the control and peppermint conditions. Peppermint produced a small increase in alertness, whereas ylang ylang produced a slight decrease. As to the cognition tests, memory was enhanced by the peppermint condition and impaired in the ylang ylang condition (Moss, Hewitt, Moss, & Wesnes, 2008).

Field et al., (2004), studied the effects of smelling a cosmetic cleansing gel where lavender was one of many ingredients. In this study, self-reports of subjects showed improved mood and relaxation after smelling the gel and that math computation speed was faster after smelling the fragrance. Specific results of the EEG used in the test indicate that subjects showed an increase in left frontal activation of the brain, an area

that is associated with greater approach behavior and a less depressed attitude (Field et al., 2004).

“Aroma molecules have direct effects on human behavior and physiology ranging from activation of memories to changes in mood or emotional states” suggest Diego et al. (1998). The team researched the inhaling of lavender and rosemary EOs in relation to mood, EEG patterns of alertness and math computations. The results indicated that the lavender increased relaxation, but decreased alertness and the rosemary increased both relaxation and alertness. In relation to the math computations, both EOs appeared to increase speed, but only the lavender EO appeared to increase accuracy (Diego et al.).

Clinical Use of Essential Oils

As scientists are able to separate and study the individual components of EOs, there is growing interest in phytotherapy. And although there are studies that find EOs to be effective in a range of medical uses, one study found that “. . . aromatherapy is no better than distilled water in relieving pain, healing wounds, boosting immune function or easing stress, (“Aromatherapy’s benefits limited,” 2008). This study’s findings can be balanced with that of Shina et al., (2007) whose research indicates that EOs have a physiological effect when inhaled. In this research 30 male subjects had blood drawn before and after an aromatherapy treatment with lavender. The results of significant reduced serum cortisol in the blood and improvement in coronary flow velocity reserve, indicates that inhalation of lavender can affect relaxation and that lavender could be used to improve circulation.

Essential Oils in Psychotherapy

Another area of research is the use of EOs in psychotherapy. La Torre (2003) suggests that EOs can be used in therapeutic sessions to aid with healing and balancing the patient. She suggests, “a particular scent may be selected because of the client’s history with it, or a new scent may be introduced to elicit feelings and discussion (La Torre). Aromatherapy has also been used effectively with patients who have depressive symptoms. Yim, Ng, Tsang, and Leung (2009) reviewed six studies that looked at this issue. Aromatherapy massage (massage with EOs in the massage oil) was used in all six studies and participants in the studied included people with schizophrenia, others with depressive disorders, cancer patients, and first-time mothers. The results of the studies indicate a significant improvement in mood, less confusion/bewilderment and decreased depression (Yim et al. 2009).

In an adolescent residential treatment center, an aromatherapy calming blend of three EOs including ylang ylang, sweet majoram, and bergamot, was made available to residents as a hand massage (transdermal application) or for direct inhalation with several drops on a cotton pad to be held beneath the nose for five to 10 minutes. This aromatherapy treatment was voluntarily chosen by the resident and could be used alone in times of crisis or agitation, or as a complement to the physician’s prescribed medication. The study was conducted to assess both the effectiveness and the acceptance of aromatherapy treatments in this setting. At the end of the three-month study, 43 adolescents had completed the survey, which showed a positive response to the use of the EOs. As to the effectiveness of the EOs, “although statistically aromatherapy was not proved to have an effect on the rate of p.r.n. medication, seclusion and restraint use and

the total number of p.r.n. medication administered decreased since the introduction of aromatherapy” (Fowler, 2006, p. 74). This study introduced a “quality of life tool” (Fowler, 2006, p. 74) into a residential facility, that empowered the residents to choose an intervention with less risk and side effects than prescribed medications, and less emotional impact than restraint and seclusion (Fowler, 2006).

Fragrances and Approach and Helping Behaviors

It has been demonstrated that people in the presence of pleasant fragrances exhibit more helping behaviors than when a fragrance is not present. It is thought by researchers that this is due to “. . . mild increments in positive affect” (Baron, 1997, p. 499). In a two-pronged study, Baron and Thomley (1994), looked at participants’ completion of an anagram task in relation to a setting with one of two fragrances, or no fragrance; or a setting where the participant received a small gift prior to performing the task. Of the scents used in the study, one was a lemon fragrance and one a floral fragrance, but it was not indicated whether the fragrances were EOs or synthetic. However, in both fragrance settings and the incidence where the participant receives a small gift, the anagram task was completed more accurately. Also, in all three settings outlined above (each of two fragrances and where participant received a small gift), participants were more willing to volunteer their services to help the people administering the test (Baron and Thomley, 1994).

In a second study, Baron (1997) literally used ambient odors in a mall including the fragrances emitting from a Mrs. Fields® Cookies store, a Cinnabon store and The Coffee Beanery. Other areas in the mall near clothing stores and other retail outlets, were utilized for the non-fragranced control area. In the study, 116 passersby were asked for

change for a dollar by one same-sex researcher and asked to participate in a survey by another same-sex researcher (not necessarily in this order). The findings indicated that a higher proportion of mall shoppers exhibited “helping behavior” by making change for the dollar when in the presence of the fragrances. The survey results indicated that a subjective analysis of mood was higher in the fragranced area (Baron, 1997).

Zemke and Shoemaker (2007) explored the use of fragrances in a social setting in relation to social interactions. This study specifically noted the importance of managing the environment to engender human interaction in the hospitality and other industries including locations such as hotel lobbies and meeting rooms, restaurants and banks. The participants were recruited at several Las Vegas “locals” casinos for a focus group. When they arrived at the location they were asked to wait for a few minutes. The waiting area was fragranced for one group of participants with geranium EO (Zemke & Shoemaker, 2007). Geranium is a warm, rich citrusy fragrance and is a balancing EO, being both uplifting and sedative. It is good for the alleviation of anxiety and nervousness (Rose, 1999, p. 84; Tisserand, 1977, p. 231). On another day, a different group of participants was asked to wait in the same room with temperature and other ambient conditions the same as the first group, but without the fragrance. Both groups were left in the room for 15 minutes and behavior was recorded via a hidden camera. Detailed analysis of the videotape was conducted using “behavioral mapping.” It revealed that, “. . . adding the pleasant scent increased the number of social interaction behaviors by approximately 52% on a per participant basis” (Zemke & Shoemaker, 2007, sec. 6.0).

The Servicescape

Overview

It is impossible to escape one's environment. It defines the space in which people act, react and interact. Fragrance is only a small piece of the many factors that contribute to the atmosphere of an environment. It is important to look at the environment as a whole to better understand its effect on customers and guests.

The servicescape or "built environment," is a term first used by Bitner (1992) to describe man-made settings. She found there to be three basic components of a servicescape: the spatial layout; ambient conditions or factors relating to the five senses; and signs, symbols and artifacts. She explains that the servicescape is particularly important in service settings because the activity is taking place onsite in the environment of the business, and therefore the activity and the environment cannot be separated (Bitner, 1992).

People respond to their environment cognitively, emotionally and physiologically and these responses influence how they react within that environment (Bitner, 1992). Mehrabian and Russell (1974) suggest that people react to their surroundings in one of two ways: approach or avoidance. Approach behavior is exhibited by engaging in the available activities, lingering in the environment, etc., where as avoidance behavior is just the opposite. For example, if one is physically uncomfortable in a setting because of temperature, glaring lights, hard and unyielding seating and loud noises, he or she will make decisions as to whether to stay in that environment—or return at a later time—based on those environmental elements (Bitner, 1992).

The physical environment's ability to influence behavior is well documented, (Bitner, 1990; Bitner, 1992; Kotler 1973; Wakefield & Blodget, 1999), with favorable perceptions leading to repatronage intentions and positive word-of-mouth (WOM) (Wakefield & Blodget 1999).

Impressions of the servicescape are different for those who have a short interaction in the environment, such as cashing a check at the bank or picking up clothes at the cleaners, than for those whose interaction is extended, such as viewing a ballgame or gambling in a casino. On the one hand, people in the first group may define the servicescape on responsiveness, assurance and empathy, i.e., how quickly the check gets cashed. Those in the second group may be more interested in less tangible elements of the environment. In these cases, the perception of the servicescape may influence length of stay, the amount of money that is spent, and repatronization intent (Wakefield & Blodgett, 1996). It has, in fact been shown that repatronization intent is influenced by satisfaction with the servicescape (Hui & Bateson, 1991). The environment's role in influencing behavior may be even more important for those consumers in leisure settings because they are pursuing hedonic, or pleasurable or emotional, experiences and are possibly more deliberately aware of the environment (Mano & Oliver, 1993).

According to Wakefield and Blodgett (1994), visits to theaters, theme parks or sporting events are motivated by one's desire to experience "excitement and stimulation." Since the servicescape itself is part of the experience, it too needs to be exciting and stimulating. If this is the case, greater levels of excitement may even be experienced by those not specifically involved with the leisure service itself (such as the companions of those seeking the excitement) if the servicescape is arresting (Wakefield and Blodgett

1994). It can be extrapolated that a casino, with its themed interiors and elements of gambling risk, would be visited for the same reason. Within the leisure service settings, well-designed interiors may lead patrons to have these experiences of excitement and stimulation (Bigné, Mattila & Andreu, 2008) which in turn may lead to repatronage and positive word of mouth.

In their first study, Wakefield and Blodgett (1994) showed that the servicescape impacts the customer's satisfaction with the service experience and influences repatronization intentions. They did not identify any of the elements of servicescape quality. In another study, (1996), they looked at five servicescape factors in five major college football stadiums, two minor league baseball games and three casinos in Reno, Nevada. These factors included layout accessibility, facility aesthetics, seating comfort, electronic equipment and displays, and facility cleanliness, but did not include any ambient factors such as smell, sound, etc., because of the difficulty of controlling these conditions in outside settings (Wakefield & Blodgett, 1996).

Layout and aesthetics were shown to be significant servicescape elements in all three settings. Cleanliness had a modest effect on perception of quality in the two sports samples, but a major effect in the casino sample. It was suggested that this was because of the differences in the amount of time spent in the different venues: a few hours in the sports venues, vs. days in the casino. According to the study,

... Satisfaction with the servicescape consistently had a stronger effect on customers' desire to stay than on their repatronage intentions, particularly in the casino sample. This finding indicates that although customers may be attracted to leisure services for a

variety of reasons, it is their satisfaction with the servicescape (in large part) that keeps them there. ... once inside the leisure service setting, the length of time these customers stay is largely dependent on their satisfaction with the servicescape. Thus, service operators who provide a good primary service may not be maximizing profits if they do not also provide it in an enjoyable, high quality environment. (Wakefield & Blodgett, 1996, pp., 52-53.)

The finding that satisfaction with the servicescape can positively influence a casino customer's desire to stay is very important in light of the fact that no money changes hands in a casino setting unless a purchase is made or one is engaged in a gaming activity (admittance to the casino is free). Wakefield and Blodgett (1999) continued their research with another study of the effects of sporting event servicescapes and re-confirmed that those who found the servicescape to be of high quality and were thus satisfied with the experience, were most likely to attend future baseball games.

Once the impact of the servicescape on guest experiences is recognized, it becomes important to manage that servicescape to provide the optimal experience for each and every customer. Lewis Carbone (2004), a leader in the experience management industry, has identified three "clues" that customers and guests use to assess their experiences: mechanical, humanic and functional. He suggests that these clues contribute to recollections and emotional connections that determine whether or not a customer will return (Carbone, 2004, pp. 81-82, 64).

The Restaurant Servicescape

In an effort to test a multi-dimensional and social view of servicescapes, Harris and Ezeh (2008) reviewed 271 surveys completed by diners who had been served by frontline staff and had consumed food and drink in a formal, tabled setting. They tested several elements in relation to perception of servicescape, including ambient conditions of aroma, music and cleanliness; design factors of aesthetic appeal and comfort of furnishings; staff behavior; staff image; personal moderating behaviors; and environmental factors. Of these possibilities, only five were found to be significantly directly related to loyalty intentions, one of which was aroma.

Hotel Servicescapes

A broad range of servicescape factors have been found to influence guest perceptions of service and the leisure service setting itself. In one study, color was found to be the most influential atmospheric component in a first impression of a hotel lobby, followed by lighting and style (Countryman & Jang, 2006). In another study, music in a hotel was found to cause guests to stay longer and spend more money in the hotel; make wait times more enjoyable; and improve satisfaction with telephone encounters—both from within the property and from the outside (Magnini & Parker, 2008)

Casino Servicescapes

One of the challenges in looking at servicescapes, is defining the components in the environment that are important to the customer. One might assume that cleanliness would be of prime importance in a sports facility, but as shown above in the study by Wakefield and Blodgett (1996), it was of only of modest importance. Mayer, Johnson, Hu and Chen (1998) surveyed 69 participants in a slot tournament in a Las Vegas,

Nevada casino about the importance of atmosphere, customer service and chance of winning. They discovered that customer service and atmosphere were interrelated. In addition, these three factors explained 57% of the variance in satisfaction with the gaming experience. However, the concept of “atmosphere” was a broadly defined term.

Another study conducted by Mayer and Johnson (2003) set out to further define the components of “atmosphere” from a slot player’s perspective. They examined data from 195 completed surveys and discovered seven factors that appeared to best describe atmosphere: “enjoyment,” which included odors, “décor and color, floor layout, theme, employee uniforms, ceiling height and noise level” (Mayer & Johnson, 2003, pp. 26-27). The important finding of this study is that it confirmed what casino managers and others have long held to be true, that floor layout and theme contributed to a casino’s financial success or failure (Mayer & Johnson, 2003). A follow-up study, with 308 completed questionnaires showed three variables out of five to be significant. The three included theme, employee uniforms and noise level. The remaining two variables, ceiling height and floor layout did not significantly relate to guest satisfaction (Johnson, Mayer, & Champaner, 2004).

In Lucas’ study (2003), ambient conditions were defined as intangible factors of the environment, or anything that would impact the senses such as sounds, temperature, etc. In addition, he looked at navigation through the casino, cleanliness, interior décor and seating comfort, factors that all contributed significantly to servicescape satisfaction. The survey used in this study also revealed that satisfaction with the servicescape positively effected the length of time spent in the casino, intent to return to the casino and intent to give the casino positive word of mouth (Lucas, 2003).

Fragrance Use in Public Spaces

Retail

Overview. The retail arena is rich with fragrances. Marketers use fragrances to help establish brand awareness of stores and products (Lindstrom, 2005; Miller, 1993). A bedding store uses a scent that will soothe its shoppers. Sony, in an effort to lure women into its stores added fragrances to provide a richer sensory experience. Bloomingdale's uses different fragrances in each department to create the proper atmosphere such as baby powder in the infant clothing department, lilac in lingerie, and coconut in swimsuits. An ice cream store used the fragrance of waffle cones to increase its sales by more than a third (Caplan, 2006).

Perfume companies, those who sell smells, hire people to wave scented strips under the noses of mall shoppers and buy full-page magazine ads with scent strips to sell their products. One of the first perfumes for the masses was developed by Eugene Rimmel in the mid 1800s. Rimmel marketed the perfume by giving away scented almanacs and fans, scented print advertising and even running scented ads in theater programs. The response among Rimmel's upper-society contemporaries was not positive, as the marketing techniques were seen as crass and obtrusive. In 1983, over one hundred years later, the famous perfume *Giorgio*, was the first perfume to be marketed in a magazine ad using the ScentStrip Sampler many people are familiar with today. Although some readers complained that the magazine smelled too strongly of the fragrance, sales of the perfume exploded (Gilbert, 2008, p. 183).

Sometimes the absence of a fragrance can be felt in a retail space. A young Starbucks chain made the move to go from open cases of coffee beans, weighed, ground and packaged on the spot, to vacuum-packed packages of coffee to save employees' time and preserve freshness. What wasn't initially considered was the fact that the sealed-in freshness also sealed in the fragrance and the more efficient retail locations lacked the welcoming smells of the coffee (Gilbert, 2008, pp. 171-172).

Fragrances, Congruence, and Music. Not every pretty smell will work in every setting. Research in the area of social psychology has shown that people seek out situations of consistency where all factors are congruent (Cialdini, 1993, as cited in Spangenberg, et al., 2006). In most settings where fragrances are added to the environment, the fragrances, although ambient – meaning that they are not coming from a specific item in the store or room – make sense. For example, the smell of waffle cones mentioned above in relation to the ice cream store, is a synthetic fragrance released into the air by a fragrance machine. However, it is not out of context in that the cones sold at the store could theoretically have created the fragrance.

Spangenberg et al. (2006), explored the effects of gender-congruent scents on retail purchases. They found the following:

“...that shoppers evaluate the store and its merchandise more favorably, and are more likely to exhibit approach behaviors in the presence of an ambient scent congruent with gender-based products in comparison to an incongruent scent (Spangenberg et al., 2006, p. 1286).

This was evidenced by the results of an experiment where the feminine ambient scent of vanilla and the masculine ambient scent of rose maroc were used at different times in a

clothing store. Among other factors, the researchers looked at perceived shopping time, number of items purchased, money spent and intention to visit the store in the future. When the fragrance was congruent (vanilla for women, and rose maroc for men), the perceived shopping time increased significantly, the number of items purchased almost doubled, the actual money spent more than doubled, and shoppers expressed stronger intentions to again visit the store (Spangenberg, et al., 2006).

Another study conducted in a retail store used EOs of lavender and ginger together, and orange and spearmint together. The results indicated there were positive, significant differences in the both the behavior and ratings of the store and its products between the fragranced and non-fragranced store settings. Two things are of specific interest in this study. First, is the fact that no one in the post-shopping interview mentioned a fragrance. Second is the fact that shoppers in the fragranced setting perceived that they had spent less time in the store than those shoppers in the non-fragranced setting (Spangenberg, Crowley, and Henderson, 1996). It was suggested that this inaccurate experience of time may be related to an optimal state of experience known as flow (Csikszentmihalyi and Csikszentmihalyi, 1988 as cited by Spangenberg, Crowley & Henderson, 1996).

Mattila and Wirtz (2001) questioned the congruency relationship between fragrances and music and the resulting effect on retail shoppers. For their study, they chose lavender as the low arousal scent and grapefruit as the high arousal scent. Both fragrances were disseminated throughout the store at different times, using ceramic diffusers. Both the high arousal music and the low arousal music compact discs used in the study were from Elizabeth Miles' Tune Your Brain™ series. The researchers found

that when the fragrance and the music were congruent—high arousal music with high arousal scent and vice versa—“. . . consumers’ evaluations of the store were enhanced” (Mattila & Wirtz, 2001).

In a mock retail setting, researchers examined the congruence between music and fragrances using Christmas music and non-Christmas music played in Christmas scent and no-scent settings. The results indicated that the survey responses were most favorable from those who had experienced the Christmas scent when the Christmas music was played. The lowest responses in most of the categories were from those who experienced no scent while the Christmas music was played (Spangenberg, Grohmann, & Sprott, 2005).

Another study of 774 adult shoppers found:

That atmospheric cues such as music and a scent were more effective at enhancing consumer response when they were congruent with individuals’ affectively or cognitively oriented shopping styles. More impulsive shoppers—that is, those who made unplanned purchases—were positively affected by the presence of background music, whereas more contemplative shoppers, or those who did not make any unplanned purchases, were positively affected by the presence of a pleasant ambient scent (Morrin & Chebat, 2005).

Bosmans (2006) corroborates these findings with a study that showed ambient scents, if congruent with a product, strongly effected customers’ impressions and evaluations of the product (Bosmans, 2006, p. 188).

Restaurants

In the Park Hyatt Vendôme in Paris, guests can sample the restaurant's signature scent when they take a bit of "Les Parfumeurs" dainty, fragile macaroons. The original idea was to create a small pastry that would be delivered to guests' rooms upon arrival, but the creation of the delicacy took so long that it was decided to offer it in the restaurant. It is now the signature desert at Les Orchidees, one of the hote's restaurnts (Burr, 2006a).

In a restaurant in Brittany, France, EOs of lavender and lemon were diffused at different times, using three electric diffusers spaced throughout the small space (22 place settings). The purpose of the study was to gage the effect of aromas on the amount of time and money spent in the restaurant. The results of this unique study (very few studies have been made in restaurants relating to fragrances) indicate that the lemon fragrance, known to be a stimulating scent, had no effect on either of the dependent variables. The same was true of the control condition where no odor was introduced into the environment. However, in the lavender-scented condition customers spent longer in the restaurant (mean of 105.7 minutes vs. 89.8 minutes for the lemon fragrance) and more money (mean of 21.1 Euros vs. 18.1 Euros for the lemon fragrance) than in the lemon-scented or control condition. The researchers suggested that the lavender fragrance, known to be a calming, soothing fragrance had relaxed the guests, causing them to linger and spend more money (Guéguen and Petr, 2006).

Casinos

The use of fragrances in casinos is widespread, and it is estimated that at least half of the casinos on the Las Vegas Strip in Nevada use fragrances (Gilbert, 2008, p. 171).

For example, several different fragrances are used throughout the MGM Grand property, and a distinctly different fragrance is used in the Mandalay Bay Casino than is used in the adjacent, luxury property called the The Hotel. However, in spite of all of the fragrance use, there has been almost no research on the guests' assessment of the experience in relation to the fragrances or any behavioral studies conducted where fragrances were or were not present. In fact, Hirsch's 1995 research on fragrance use in a casino is possibly the only published study to date that focuses on this topic. It is discussed in detail in the following chapter, as it is the model for the experiment conducted in this study.

Summary

Research indicates that fragrances have an effect on human behavior and effect individuals both psychologically and physically. It is also important to note that fragrances have been shown to increase the time spent in a public setting and the amount of money that is spent in those settings. Finally, the fact that fragrances can help one enter a state of "flow" is of importance to the casino industry. In Chapter 3, the experiment conducted to determine the effect of fragrances on coin-in will be described in detail.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

Introduction

The purpose of this experiment was to examine the effects of fragrances on the slot machine gaming experience of casino patrons. The research was also designed to gauge the efficacy of natural versus synthetic fragrance sources as to the effects on customers in the casino setting. This research expanded on an earlier experiment conducted by Alan R. Hirsch in a large Las Vegas, Nevada casino. Hirsch (1995) used two different odorants to fragrance 18 slot machines and 28 slot machines respectively in different areas of the casino for a 48-hour period over a weekend. A third, non-odorized bank of 22 slot machines was used as a control area. Coin-in was the measurement used to examine the effects of the two fragrances. According to Hirsch's study, the coin-in of the slot machines related to the first odorant was on average, 45.1% higher than the coin-in for the same slot machines during the weekends before and after the experiment took place. In Hirsch's experiment, the coin-in from the slot machines in the second odorant and control areas did not change significantly (Hirsch, 1995).

Research Hypotheses

This study's research hypotheses are as follows:

H1: An ambient fragrance in the casino will affect the coin-in of slot machines.

H2a: An ambient stimulating/refreshing fragrances will result in more money spent at the slot machines than if a soothing fragrance or no fragrance was present. H2b: An ambient soothing fragrance will result in more money spent at the slot machines than if a stimulating/refreshing fragrance or no fragrance was present.

H3a: A fragrances formulated with a high percentage of natural components or essential oils will result in more money spent at the slot machines than will a fragrance formulated predominately from synthetic materials. H3b: A fragrance formulated with a high percentage of synthetic components will have the same effect on money spent at slot machines as a fragrance derived from a high percentage of natural components or essential oils.

Research Design

Overview

The experiment was conducted at a large American casino with data collection taking place over a 20-day period beginning June 25, 2007 and ending on July 15, 2007. Fragrance emitting machines were directly placed in five discrete locations throughout the casino. The machines used a static charge to emit the fragrance and were of the same make and model as the machines used in the Hirsch experiment (Hirsch, 1995) according to Mark Peltier, the manufacturer (personal communication, April 2007).

Pre-Experiment Setup

The equipment was set up on June 21, 2007. During the four days following that time, the equipment was tested in relation to optimum levels for fragrance dispersion. Although coin-in data was available during this time, it was not included in the final calculations.

Fragrance Machine Operations

The machine used for the experiment was the EAS-1000S Standard Environmental Aroma System manufactured by AromaSys, Inc. in Minneapolis,

Minnesota. The EAS-1000 is a very simple machine to operate with a fan, an output control, and a slot for the fragrance cartridge. The approximately 4” fragrance cartridge has a wick that runs through it to the top, and the bottom of the cartridge has a cam lock to hold it in the machine. The operation of the EAS-1000 “is based on a patented method of vaporizing aromatic liquids using an electrostatic charge” (Peltier, p. 5).

Machine Placement

The fragrance machines were placed throughout the casino based on several criterion. First, the machines in the surrounding area had to be slot machines—no video poker machines were included in the study. Second, there was the need to protect the fragrance equipment from casino guests, so the fragrance machines had to either be recessed in a small carousel of slot machines or placed in some other secured area. Third, there was the need to have easy access to the equipment for monitoring purposes and changing fragrances. Fourth, the fragrance machines required electricity to operate. Locations were numbered one through five in the order they were chosen on a preliminary tour of the property with casino personnel. The group of slot machines fragranced by each of the machines will be referred to as a “bank” (i.e., Bank 1, Bank 2, Bank 3, Bank 4, Bank 5).

The first fragrance machine was placed within Bank 1 in a small storage area with a door, open at the top, and surrounded by a circle of ten slot machines. Bank 1 consisted of 42 slot machines of varying denominations.

The second fragrance machine was placed within Bank 2 in a small storage area with a door, open at the top, surrounded by a circle of 12 slot machines. Bank 2 consisted of 36 slot machines of varying denominations.

The third fragrance machine was placed within Bank 3 in a small storage area with a door, open at the top, surrounded by a circle of 10 slot machines. Bank 3 consisted of 74 slot machines of varying denominations.

The fourth fragrance machine was placed within Bank 4 in the center of a small carousel of three slot machines. Bank 4 consisted of 48 slot machines of varying denominations.

The fifth fragrance machine was placed within Bank 5 in the center of a small carousel of three slot machines. Bank 5 consisted of 53 slot machines of varying denominations.

The number of slot machines in each bank was designated based on the distance from the fragrance machine. All slot machines included in the experiment were within 25 feet or less of the fragrance machine. Data were obtained from 253 individual slot machines throughout the 20-day experiment and approximately two and one half months prior (pre-test data).

The Fragrances

Four fragrances were used in the experiment: two refreshing blends, REF1 and REF2, and two soothing blends, SOO1 and SO2. Eileen Kenney, vice president and fragrance developer, AromaSys, Inc., created the fragrances for use with the company's clients and suggested the designations of the fragrances as soothing and refreshing based on her experiences and knowledge (E. Kenney, personal communication, November 2, 2009).

The first refreshing fragrance—REF1—contained 36% natural ingredients and was a blend of lavender, orange, lime, rose, musk notes, jasmine and berry

notes. The natural ingredients included orange, lime, jasmine and lavender oils (E. Kenney, personal communication, October 15, 2007). See Table 1 for a list of properties of all of the natural ingredients used in the blends. The second refreshing fragrance—REF2—contained 80% natural ingredients and was a blend of natural lavender, sage, and cedarwood.

The first soothing fragrance—SO1—contained 5% natural ingredients and was a blend of sandalwood, patchouli, cedarwood, citrus, neroli and lavender. The natural ingredients included sandalwood, lavender, patchouli and neroli (E. Kenney, personal communication, October 15, 2007). The second soothing fragrance—SO2—contained 42% natural ingredients and was a blend of citronella, geranium, eucalyptus, cinnamon, bergamot, cedarwood, vanilla, lavender, orange, sandalwood and patchouli. Natural ingredients included cedarwood, cinnamon, eucalyptus, lavender, orange, patchouli and sandalwood (E. Kenney, personal communication, October 15, 2007). To clarify, REF2 and SO2 have the highest percentage of natural ingredients, and REF1 and SO1 have the highest percentage of synthetic ingredients (E. Kenney, personal communication, October 15, 2007).

Table 1

Properties of Natural Fragrances

Fragrance	Properties
Cedarwood	tonic, stimulating action on the body; reduces stress and tension; ^a engenders feelings of strength and fortitude ^b
Cinnamon	calms exhausted feeling of depression ^a
Eucalyptus	cooling and deodorizing effect; ^a helps balance moods ^b
Jasmine	deeply relaxes; lifts depression; boosts confidence; emotionally warming; ^a engenders feelings of optimism, and confidence and is exhilarating ^b
Lavender	soothing; calming; especially balancing -- bringing one to a place of balance where physical and emotional healing can take place ^a
Lime	stimulates and refreshes a tired mind; helps eliminate depression ^a
Neroli	lifts depression; soothing characteristics ^a
Orange	sunny, radiant; brings happiness and warmth to the mind ^a
Patchouli	helps lift depression; induces euphoria; grounding and balancing effect on the emotions; banishes lethargy; sharpens the wits; reduces anxiety ^a
Sage	quickens the senses; reduces stress and tension
Sandalwood	physical, spiritual and emotional healer; harmonizing and calming effect that reduces tension; ideal for use with depression, hectic daily lifestyles and states of fear, stress, nervous exhaustion, chronic illness and anxiety ^a

Note. ^aKenney, E., personal communication, October 15, 2007; ^bWatson, 1995

Fragrance Rotation

Each bank of slots hosted each of the four fragrances for four days during the experiment. For one four-day period, no fragrance was emitted in each area as a control function. To decide the order of rotation for the fragrances through the five banks of slot machines for the 20-day period, the name for each fragrance and was written on a separate piece of paper, including a slip for “non-fragranced,” and drawn at random for the first four-day testing period. On the fifth day of the experiment, between the hours of 5 a.m. and 6 a.m. fragrance vials in machines 1 through 4 were moved to the next numbered machine. The fragrance vial in machine 5 was moved to machine 1 as indicated in Table 2.

Table 2

Fragrance Order by Bank of Slot Machines

Days	Bank1	Bank 2	Bank3	Bank 4	Bank 5
1 through 4	Control	SO2	REF1	REF2	SO1
5 through 8	SO1	Control	SO2	REF1	REF2
9 through 12	REF2	SO1	Control	SO2	REF1
13 through 16	REF1	REF2	SO1	Control	SO2
17 through 20	SO2	REF1	REF2	SO1	Control

The process of moving fragrances was repeated between 5 a.m. and 6 a.m. every fifth morning throughout the experiment. This time was chosen for two reasons. First, it was the least busy time in the casino so the changing of the fragrances was not disturbing to too many casino patrons. Second, the coin-in data was pulled at 7 a.m. each morning and therefore the times the fragrances were being disseminated reflected the coin-in data as closely as possible.

Equipment Maintenance

Each morning between June 25, 2007 and July 15, 2007, the fragrance machines were inspected, fragrance levels recorded, and any necessary maintenance was conducted. The only exception to this was Friday, July 5, 2007 when no maintenance was conducted, and Saturday, July 6 when the maintenance was conducted between 3 and 5 p.m.

Inspection of the machine included a test to insure that the electrostatic system was working and confirmation that the fan was running and in good order. The fragrance levels were recorded based on lines made on the fragrance canister. The only maintenance required was cleaning the filter, which was conducted once during the 20-day period. In addition, a personal fragrance-level check was conducted to ensure that the fragrances were slightly above threshold level in all of the fragranced slot machine banks.

Data Collection and Analysis

Coin-in data for each machine covered in the experiment was collected by the casino every morning at 7 a.m. This information was recorded and provided to the researcher in a spreadsheet by the casino.

The data will be analyzed using a Generalized Linear Model (GLM). This model was chosen because of its ability to take into account many different factors and evaluate their effect on a specific variable, in this case coin-in. A 95% confidence interval will be used as is appropriate in a regression-type analysis (Montgomery, 1991, p. 33).

CHAPTER 4

DATA ANALYSIS AND RESULTS

The purpose of this study was to determine whether fragrances effected coin-in. This was operationalized by considering the daily coin-in (“drop”) in each machine and how it varied given the different types of fragrances emitted at its station (pretest; control- no fragrance; REF1- stimulating synthetic; REF2- stimulating natural; SO1- soothing synthetic; SO2 soothing natural). The coin-in was collected from each machine at 7 a.m. each day during the study. Therefore, the unit of analysis is the individual machine (rather than a particular person). There were five rotations of the different fragrances around the casino floor in the slot area over a 20-day period. This resulted in approximately 21,000 individual data points which were used in the analysis for the 253 machines over the three and a half month period (including pre-test data).

Because other factors could have influenced coin-in, those were considered in the overall model—month (May, June, July); day of the week; holiday (Memorial Day, 4th of July); machine denomination (penny, two cents, nickel, twenty cents, quarter, fifty cents, dollar,); area of the casino (area 1, area 2, area 3; area 4; area 5); and configuration of the machine/chairs (9” diameter, 16” diameter, round, slant, special). Three generalized linear models (GLM) were run—the first model included month, day of week, machine denomination, area of the casino and configuration of the machine. The second model added fragrance, and the third model added the holiday information in addition to fragrance. That last model was found to be the most robust.

The results of this model are presented in Table 3. As indicated by the p-values, the majority of these factors were significant including the months of May and June;

Areas BB, BC and BE; the denominations (amount per credit) of \$1, 50¢, 5¢, 25¢, 20¢ and 2¢; all of the days of the week; the fragrance pretest data and SO2 and REF2; the two holidays, Memorial Day and the 4th of July; and two of the seating configurations.

However, what is most relevant to this investigation is that fragrance itself was also a significant factor. Therefore, when considering all other factors that had been thought to previously impact coin-in, fragrance exerted a significant effect, supporting Hypothesis 1.

Table 3

Results of GLM Three

Term	Estimate	SE	t	Pr(> t)
Intercept	8.235	0.184	44.696	0.000
Month-July	0.010	0.025	0.383	0.702
Month-June	-0.102	0.012	-8.798	0.000
Month-May	-0.119	0.011	-11.190	0.000
Area-BB	-0.848	0.024	-35.381	0.000
Area-BC	0.124	0.016	7.922	0.000
Area-BD	-0.011	0.016	-0.712	0.477
Area-BE	-0.331	0.017	-19.872	0.000
Proximity-B	0.019	0.011	1.715	0.086
Proximity-C	-0.059	0.024	-2.463	0.014
Denom-Dollar	0.351	0.071	4.927	0.000
Denom-Fifty¢	-0.188	0.092	-2.052	0.040
Denom-Nickel	-0.184	0.072	-2.557	0.011
Denom-Penny	-0.023	0.066	-0.343	0.732
Denom-Quarter	-0.212	0.067	-3.162	0.002
Denom-Twenty¢	0.924	0.077	11.955	0.000
Denom-Two¢	0.512	0.068	7.523	0.000
Day of Wk-Mon	-0.450	0.016	-28.349	0.000
Day of Wk-Sat	0.403	0.016	25.806	0.000
Day of Wk-Sun	0.084	0.015	5.458	0.000
Day of Wk-Thu	-0.432	0.016	-27.762	0.000
Day of Wk-Tue	-0.488	0.015	-31.903	0.000
Day of Wk-Wed	-0.507	0.016	-32.501	0.000
Fragrance Pretest	-0.158	0.028	-5.717	0.000
Fragrance-SO1	-0.007	0.028	-0.258	0.796
Fragrance-SO2	0.075	0.029	2.618	0.009
Fragrance-REF1	0.028	0.029	0.987	0.324
Fragrance-REF2	0.060	0.031	1.925	0.054
Config-16"	0.579	0.172	3.371	0.001
Config-9"	-0.170	0.171	-0.992	0.321
Config-Round	-0.260	0.171	-1.517	0.129
Config-Slant	0.440	0.171	2.565	0.010
Config-Spec	0.854	0.173	4.939	0.000
Day-July 4	0.582	0.045	12.843	0.000
Day-May 28	0.647	0.042	15.327	0.000

The focus then turns to what type of fragrance had the most impact on coin-in—refreshing or soothing? Or more natural or synthetic? The means for each fragrance appear in Table 4. The means are plotted in Figure 1 with the Upper and Lower confidence intervals indicated. As shown in Figure 1, there is no overlap between confidence intervals which indicates that the mean coin-in values are significantly different for the five fragrance types. Since 95% Confidence Intervals for Drop for S02 (soothing natural) and REF2 (stimulating natural) are higher than that of the control (no fragrance condition), it appears that the more natural or essential oil-based fragrances drive coin-in, whereas the synthetic fragrances lead to less coin-in and that the type of fragrance (soothing vs. natural) does not matter significantly. Therefore, there is support for Hypothesis 3a—that essential oils are more effective than synthetic ones (and Hypothesis 3b is rejected—that synthetic oils should work equally as well). However, neither Hypothesis 2a concerning the refreshing aroma (and its ability affect coin-in) nor Hypothesis 2b considering the soothing aroma (and its ability affect coin-in) is supported, so it is not clear exactly why the EOs used in this study were effective in enhancing the gamblers' experience.

Table 4

Descriptive Statistics of Drop by Fragrance Type

Fragrance	Mean	Median	sd	L95	U95
Control	3438.740	2752.250	2867.350	3400.070	3477.410
SO1	3088.020	2589.280	2398.470	3055.673	3120.367
SO2	3788.690	2861.630	3723.600	3738.472	3838.908
REF1	3197.260	2518.060	2651.880	3161.495	3233.025
REF2	3686.250	3144.010	2534.320	3652.071	3720.429

Note: Mean = mean of the coin-in data for each fragrance condition; Median = median amount for the coin-in data for each fragrance condition; sd = standard deviation; L95 = lower confidence interval; U95 = upper confidence interval.

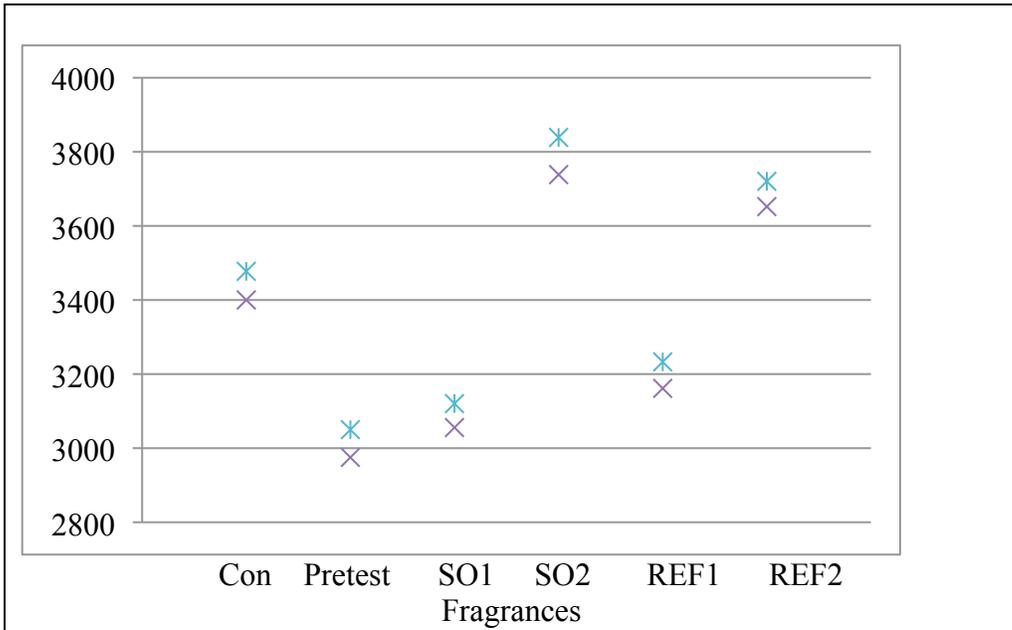


Figure 1. Upper and lower confidence intervals for fragrances.

Note: The vertical axis reflects the means, and the horizontal axis shows the fragrances. The asterisk indicates the upper confidence interval for each fragrance and the “X” indicates the lower confidence interval for each fragrance. Control = non-fragranced condition; Pretest = coin-in data from the 253 slot machines approximately 2.5 months prior to the experiment; SO1 = soothing/synthetic fragrance; SO2 = soothing/natural fragrance; REF1 = refreshing/synthetic fragrance; REF2 = refreshing/natural fragrance.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

Comments, Implications and Suggestions

Fragrance as Significant

The results indicate that fragrances, in general, significantly affect coin-in of slot machine players in a casino setting. More specifically, the two fragrances that significantly, positively affected coin-in, had the highest percentage of natural fragrances of the four tested (REF2, 80%; SO2, 42%) (E. Kenney, personal communication, October 15, 2007). Finally, of the two fragrances that are shown to be significant, one is considered by the manufacturer to be a refreshing fragrance (REF2), and one is considered to be a soothing fragrance (SO2) (E. Kenney, personal communication, October 15, 2007).

In this experiment, because the only dependent variable was coin-in, other possible factors that would have contributed to coin-in must be inferred. Coin-in could be impacted by the number of people gambling in the area, the amount of time spent gambling in the area by each of the guests, and the amount of money each person spent per spin. There is research to suggest that the fragrances could affect all three scenarios.

First, some of the gamblers may have simply been attracted to the fragranced banks of machines because they found the smell to be pleasant and then lingered to enjoy the aroma. Perhaps they felt comfortable in the space and didn't make a conscious judgment as to why. This partial explanation for the significance of fragrances in general has been demonstrated in other studies including a 1932 experiment where door-to-door surveys were conducted of women in Utica, New York. Shown four pairs of identical silk

hose, they were asked to choose their favorites. Three of the pairs of hose had different fragrances, and one pair had no fragrance. Out of the 250 women who were interviewed, only six mentioned that some of the hose were scented, but 92 percent of the women chose as their favorite one of the three pairs of hose that were scented over the single pair that was not (Gilbert, 2008, p. 181).

Another contributing factor may have been that the fragrance put the gamblers in a state of flow where one's impression of time is distorted (Csikszentmihalyi, M., & Csikszentmihalyi, 1988), and that extended the amount of time that was spent playing the games. This would be similar to the experience of retail shoppers who either overestimated or underestimated the amount of time that they spent browsing and shopping in a store with a pleasant fragrance (Spangenberg et al., 1996; Spangenberg et al., 2006). In yet another study it was demonstrated that in the presence of a fragrance, people indicated that they were willing to spend more for a pair of Nikes than people who were asked the same question in a non-fragranced setting (Brumfield et al., 2008, p. 35).

Natural Fragrances as Significant

Natural fragrances have been shown to effect mood (Herz, 2009), lessen anxiety (Lehrner et al., 2005) and increase alertness (Moss et al., 2003). All of these factors could contribute to the positive, significant impact on coin-in of the two fragrances with the highest percentage of fragrances from natural sources.

It would be inappropriate to pick out and ascribe the various attributes of the specific fragrances in a blend to the individual. For example, to say that the sage in REF2 contributes to a gambler's hedonic needs because it heightens the senses (Lawless, 1995, p. 181), would be inaccurate. Rather, the blends must be considered as a whole,

especially in this case where the specific percentages of each fragrance are unknown. In addition, the combination of two or more EOs or natural fragrances creates a synergy. “By mixing together two or more essential oils you are creating a chemical compound that is different to any of the component parts, and these synergistic blends are very particular and powerful” (Worwood, 1991, p. 10).

The designations of “refreshing,” and “soothing,” came from the manufacturer based on experience with fragrances (E. Kenney, personal communication, November 2, 2009).

Refreshing and Soothing Fragrances as Significant

Although it may at first seem counter to reason that both a refreshing blend (REF2) and a soothing blend (SO2) were shown to significantly effect coin-in, this in fact makes sense. People come to play the slot machines for many different reasons, bringing with them the entire spectrum of psychological states (Cotte, 1997). It makes sense that some people will want to be uplifted, refreshed and perhaps stimulated and that will keep them playing longer, while others will enjoy being soothed and relaxed and it will have a similar effect.

In that same vein, one of the original hypotheses for the study was that refreshing fragrances would have more of an impact on the gambling experience of slot machine players in the late evening hours (11 p.m. to 7 a.m.) than a soothing fragrance. Another hypotheses was that a soothing fragrance would have more of an impact on the gambling experience during the day (7 a.m. to 11 p.m.) than a refreshing fragrance. These hypotheses were based on the idea that perhaps people gamble to unwind and that a soothing fragrance in the daytime might add to the length of play, whereas a refreshing

fragrance would keep people awake at night. Although this data was not available because the casino only recorded coin-in information once every 24 hours, the concept still holds and could be another explanation as to the reason that both a refreshing and a soothing fragrance were shown to be significant.

A related possibility, is that for some of the gamblers, the soothing fragrance helped them maintain an emotional equilibrium and therefore did not experience the highs and lows of anticipation and expectation. This cycle of ups and downs has been shown to lead to burnout and shortened amount of time spent gambling (Cotte & LaTour, 2009).

Managerial Considerations

Many casino managers/owners are already using fragrances in their properties for a variety of reasons, including branding (Gross, 2007; Jeffries, 2007; “Trend Alerts”), to enhance the ambience and heighten the experience of the guests (Gross, 2007), and to continue the impact of the casino experience on the guest after he or she leaves the property (“Fragrance of Success,” 2006). Based on this study, the decision to continue to use or begin including ambient fragrances in the servicescape is a good one.

However, the decision to continue to use/create fragrances that are simply pleasant, versus using/creating fragrances that address the desired psychological and perhaps even physical state of the guest is another matter. First, if the fragrance is used to strengthen or enhance the brand of the property, management will not be interested in changing the formula unless the smell will remain consistent. Second, managers must first make a determination as to the desired psychological state of the guests and then work with an aromatherapist who will help designate a variety of oils that can engender

that psychological state. Third, the cost of natural fragrances or EOs must be taken into consideration. Natural fragrances can cost more than 40 times the cost of synthetic fragrances (Turin, 2006, p. 23). Managers wishing to explore the use of natural fragrances may find it is possible to replace some of the synthetic fragrance components in an existing fragrance blend currently in use to achieve the same, “smell.” This would also keep the cost lower: a blend of synthetics and natural fragrances will cost less than a fragrance composed totally of EOs or natural components.

Finally, there is the consideration of ethics. Armed with the knowledge that certain fragrances may engender certain psychological states in casino guests, is it ethical to use these fragrances to influence coin-in? Is it appropriate to use certain colors in restaurants and other places to make guests feel hungrier or leave quicker to allow for other guests to be seated and served? Should shampoos all be fragrance free and in look-alike packages so consumers make purchase decisions based on the product’s effectiveness alone? This decision to use targeted fragrances must be made on a case-by-case basis as owners and managers discuss the ethics and relative merits of such an action.

Challenges

Although the experiment was well-planned and executed, there were many factors that were beyond the control of the researcher. First, there was the question of the equipment itself. Although easy to use, the EAS-1000S did not have a sensitive meter for measuring the amount of fragrance that was being disseminated. The researcher resorted to marking the fragrance cartridge to ensure that fragrance was in fact, being used. Also, one of the machines was not functioning and several days worth of data for one of the

fragrances was unusable. On more than one occasion, the fragrance level had not moved at all in a 24-hour period and that data was excluded from the final analysis. Another issue was the height of the ceilings and the HVAC system that turned over the air in the casino several times an hour.

One of the original hypotheses of the experiment, as mentioned above, was that refreshing fragrances would be more effective at enhancing the gambling experience in the late evening hours, and that soothing fragrances would be more effective during the day. The fact that the casino recorded coin-in for each machine only once during a 24-hour period required the elimination of these hypotheses from the study.

Limitations of the Study

One of the limitations of the study is that the research cannot be generalized to all gamblers, as it focused entirely on the coin-in for reel-slot machines only. Video poker machines and table games were not included in the study.

Further Research

This experiment has perhaps raised more questions than it has answered. For example, what was the subjective experience of the gamblers in the fragranced areas? A replication of the study, coupled with a survey of gamblers in the fragranced areas, could reveal much about the gamblers themselves: their psychological state; whether they noticed the fragrance; how long they had been in the area; whether they planned to continue gambling in the area; whether they intended to remain in the casino; and whether they would recommend the casino to others, among other things.

One question raised by the study involves the actual psychological feelings of gamblers at the slot machines. So, the question becomes, “How do gamblers feel?” It is

one thing to know that certain EOs can elicit psychological feelings, but what feelings does one want to elicit? There is much research on why gamblers gamble (Cotte, 1997), but there is a dearth of information about their specific psychological states. For example, Are they excited? Happy? Filled with self-esteem? Hopeful? Research needs to be conducted to discern the psychological states of gamblers so the right EOs can be targeted.

Casino managers/owners will also be interested in whether the fragrance blends that showed to be significant will have the same effect for video poker players or table game players. Video poker and table games require more concentration and skill and different fragrances may be found to be more effective than those used in this study.

Finally, because casinos throughout the world attract international guests, the fragrance preferences of people from different cultures should be examined. No matter what the effects of the natural fragrances, if the fragrances are perceived to be unpleasant, the guests will not remain in the area.

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